Examples of bonus declared 1854:—

| Age when Assured. | Sum Assured. | Reversionary Bonus now added. | Sum now Assured. | Amount of Premiums paid. | Per Centage of Bonus on Premiums paid. | Per Centage of Bonus on Sum Assured. |
|---|---|---|---|---|---|---|
| | £. | £. | £. | £. | | |
| 29 | 500 | 75 | 575 | 120 | 62·5 | 15· |
| 35 | 1,000 | 162 | 1,162 | 283 | 57·24 | 16·2 |
| 43 | 1,000 | 179 | 1,179 | 365 | 49· | 17·9 |
| 51 | 1,000 | 207 | 1,207 | 477 | 43·4 | 20·7 |
| 58 | 1,000 | 253 | 1,253 | 644 | 39·3 | 25·3 |

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# INSTITUTE OF ACTUARIES.

As on the last occasion, we publish the questions for the Second Year's Examination, which we understand has, on the whole, been very satisfactorily met. The third year's examination will take place for the first time in December, 1855.

### SECOND YEAR'S EXAMINATION, 1854.

1. Explain the difference between common and Naperian logarithms, and why it is desirable to retain both systems.

2. Given $\log. n = M\left\{(n-1)-\frac{1}{2}(n-1)^2+\frac{1}{3}(n-1)^3-, \&c.\right\}$ where M is the modulus of the system whose base is $a$, to find $\log. \frac{1+n}{1-n}$.

3. Find the values of $\log. (1+n)$, $\log. (1-n)$, and $\log. \frac{1+n}{1-n}$, when $n=1$.

4. In a table of logarithms it is observed that the difference between the logarithms of contiguous numbers diminishes as the numbers themselves increase. Explain this.

5. Show how to find the number corresponding to a logarithm found only partially in the tables.

6. If $n$ balls, $a$, $b$, $c$, $d$, &c., be thrown promiscuously into a bag,—and two balls be drawn out, show that the probability that these will be $a$ and $b$ is $\frac{2}{n.(n-1)}$.

7. In an ordinary lottery, show that, *à priori*, the chances are the same, whether a person is to draw first or last or intermediately.

8. Find the probability that some two at least out of three lives will be alive at the end of the $n$th year.

9. Show that the probability of a single life failing in any assigned year, as the $x$th from the present time, is $p_{x-1}-p_x$.

10. Two lives, A and B, being proposed, find the probability that A will die before B.

11. Find the amount in $n$ years of an annuity certain of £$a$ at $i$ per cent. compound interest.

12. Express the value of an annuity on a given life, and convert the formula into one which gives the value of an annuity at any age in terms of the next higher age.

13. Find the value for $n$ years of an annuity certain commencing with £1 and increasing by £1 each year.

14. If the first payment of an annuity certain be £$a$, and the future payments be increased by £$p$ each year, find the value of such annuity for $n$ years.

15. Find according to the columnar method the value of an annuity on a single life, commencing with £1 and increasing by £1 each year until death.

16. If the first payment of a life annuity be £$a$, and the following payments be decreased by £$p$ annually, find the value of the annuity.

17. State algebraically the difference between the amount of £1 in 1 and 2 years respectively, when $\frac{1}{m}$th of the interest is converted into principal $m$ times in each year, instead of the whole interest once a year.

18. Find the present value of £1 at the end of $n$ years, $\frac{1}{m}$th of the interest being converted into principal $m$ times in each year.

19. What is the present value of £10 payable two and a half years hence, on M. D'Alembert's hypothesis, compound interest at 5 per cent.?

20. State briefly the practical objections to M. D'Alembert's reasoning on this subject.

21. Explain the relative advantages attending the D and N column system of construction, and the common method of forming tables of life annuities.

22. Explain the difference between Barrett's formula and Davies's, for finding the value of an annuity on a single life; and show how a table is constructed according to Barrett's method.

23. Show how a table of the probabilities of survivorship between two lives may be readily constructed.

24. Show how to construct a table of single and annual premiums for the assurance of £1 on a single life, according to the columnar method.

25. Find the value of an annuity on the life of A after the death of B; also the value of the annuity during the life of the survivor.

26. Find $\underset{1}{\mathfrak{A}}\mathfrak{B}$, the present value of £1 to be received at the end of the year in which A dies, provided he die while B is living.

27. The value required in the preceding question being unknown, find the annual premium for the contingency therein mentioned.

28. Express the value of an annuity on $n$ lives, to continue so long as any one of them exists.

29. Determine the value of an annuity on the life of A, to commence at the death of B and C.

30. Given $\mathfrak{ABC}_{1.11}$, the present value of £1 payable at decease of the survivor of two lives A and B, provided that C die first or last of the three; find the equivalent annual premium to be paid during the continuance of the risk.